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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/643,841	08/19/2003	Kin Nang Lau	009661-0052-999	4914

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EXAMINER	
DSOUZA, JOSEPH FRANCIS A	
ART UNIT	PAPER NUMBER
2611	

DATE MAILED: 12/12/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/643,841	LAU, KIN NANG	
	Examiner	Art Unit	
	Adolf DSouza	2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 August 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 - 19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *9 - 16, 19* is/are allowed.

6)☒ Claim(s) *1 - 4, 17 - 18* is/are rejected.

7)☒ Claim(s) *5 - 8* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *5/7/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Claim Objections

1. Claims 1, 5 and 9 are objected to because of the following informalities:

In claim 1, the acronyms MIMO, CSIR and CSIT should be changed to Multiple-Input-Multiple-Output (MIMO), Channel State Information Receiver (CSIR) and Channel State Information Transmitter (CSIT) respectively.

In claims 5 and 9, n_T x n_T should be corrected to n_R x n_T.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1 – 4, 17, 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lau et al. (The Role of Transmit Diversity on Wireless Communications – Reverse Link Analysis With Partial Feedback, December 2002, IEEE Transactions on Communications, pages 2082 – 2090; hereafter referred to as Lau(1)) in view of Lau

(Optimal Transmission Design For MIMO Block Fading Channels With Feedback Capacity Constraint, April 2003, Information Theory Workshop, pages 94 – 98; hereafter referred to as Lau(2)).

Regarding claim 1, Lau (1) discloses a MIMO system (Abstract; Fig. 1; page 2083, section II, 1st 4 lines) comprising:

at least one mobile unit configured to transmit a signal based on a selected power matrix and a selected beam-forming matrix (page 2084, section A; wherein the transmission strategy would depend on the beam forming matrix and the power control matrix);

and a base station configured to receive the signal from the at least one mobile unit (Fig. 1; page 2083, section II, 1st 4 lines) , the base station comprising:

a CSIR estimator configured to receive the signal and estimate a channel matrix for the at least one mobile device (page 2083, left column, last line – right column, 1st line; wherein the CSIR estimator is the channel estimator in the receiver);

and broadcasting an index to the at least one mobile unit, the index corresponding to a region of a channel matrix space enclosing the estimated channel matrix of the at least one mobile unit (page 2084, left column, section A; wherein the index broadcast to the mobile unit is the scalar information $g_{fb,k}(\mathbf{h})$;

wherein the selected power matrix and the selected beam-forming matrix are selected based on the index broadcast by the CSIT generator (page 2084, left column, section A; wherein the index broadcast from the CSIT generator in the base station is the scalar information $g_{fb,k}(\mathbf{h})$ that is used to select the $\mathbf{p}_k$ matrix for the k^{th} user).

Lau (1) does not explicitly disclose a CSIT generator that generates the index.

In the same field of endeavor, however, Lau (2) discloses a CSIT generator that generates an index (Fig. 2(b) element CSIT; page 95, section B, 1st 2 paragraphs; wherein the index fed back is the $\{u_1 \ldots u_n)$ vector.

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lau (2), in the system of Lau (1) because this would enable the mobile unit to use the optimal transmission strategy, as disclosed by Lau(2) (page 96,right column, Step 1).

Regarding claim 2, Lau (1) discloses at least one mobile unit further comprises:

at least one antenna configured to transmit a signal to a base station (Fig. 1; page 2083, section II, 1st 4 lines);

a transmitter configured to transmit a signal containing an encoded data stream over the at least one antenna (page 2083, section II, lines 8 – 10; Fig. 1 shows mobiles with antennas);

and a power and beam-forming control configured to retrieve a power control matrix and beam-forming matrix from a set of pre-stored power control and beam-forming matrices based on the extracted index (page 2084, section A; wherein the power and beam forming matrix $\mathbf{p}_k$ is selected according to the scalar information $g_{fb,k}(\mathbf{h})$);

wherein the transmitter generates the transmitted signal by modifying the encoded data stream with the retrieved power control matrix and beam-forming matrix (page 2084, section A; page 2083, section II, lines 8 – 10).

Lau(1) does not disclose an index decoder that extracts the index.

In the same field of endeavor, however, Lau (2) discloses an index decoder configured to receive a partial feedback signal and extract an index associated with the mobile unit from the partial feedback signal (page 95, section B, wherein the index decoder function is interpreted as being understood since "the transmitter at fading block n has knowledge of the feedback CSIT **u** symbols).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lau (2), in the system of Lau (1) because this would enable the mobile unit to use the index to use the optimal transmission strategy, as disclosed by Lau(2) (page 96,right column, Step 1).

Regarding claim 3, Lau (1) discloses that the selected power matrix and selected beam-forming matrix are selected from a set of transmission matrices, each member of the set comprising a power matrix and a beam-forming matrix and representing a partition of a

channel matrix space of size K x n_R x n_T where K is a number of mobile units within a cell of the base station (page 2084, section A; wherein the selected power and beam forming matrix selected is the $\mathbf{p}_k$ matrix based on $g_{fb,k}(\mathbf{h})$ and the K matrices are for the K users) each mobile unit transmitting on n_R antennas, the base station transmitting on n_T antennas, (Fig. 1; page 2083, section II, 1st 4 lines) the set of transmission matrices generated to optimize the capacity of the system (page 2083, section III).

Regarding claim 4, Lau (1) discloses that the set of transmission matrices is generated at the base station (page 2083, left column, last line – right column, 1st line; page 2083, section III, 2nd paragraph; wherein the base station is the receiver).

Regarding claim 17, Lau (1) discloses a MIMO wireless base station (Abstract; Fig. 1; page 2083, section II, 1st 4 lines) comprising: at least one antenna configured to receive a signal from at least one mobile unit (Fig. 1; page 2083, section II, 1st 4 lines); a receiver configured to receive the signal from the at least one antenna (page 2083, section II, Equation (2) which shows the signal received by the receiver).

All other limitations of claim 17 are as analyzed in claim 1 above.

Claim 18 is similarly analyzed as claim 2.

Allowable Subject Matter

4. Claims 5 – 8 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

5. Claims 9 – 16, 19 are allowed.

Other Prior Art Cited

The prior art made of record and not relied upon is considered pertinent to the applicant's disclosure.

The following patents are cited to further show the state of the art with respect to MIMO systems:

Affes et al. (US 20020051433) discloses Interference suppression in CDMA system that uses MIMO.

Provencher (US 4,032,922) discloses a multibeam adaptive array.

Sreenivas (US 5,093,668) discloses a multiple-beam array antenna.

Dent (US 6377558) discloses Multi-signal transmit array with low intermodulation.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Adolf DSouza whose telephone number is 571-272-1043. The examiner can normally be reached on Monday through Friday from 8:00 AM to 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad Ghayour can be reached on 571-272-3021. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Adolf DSouza
Examiner
Art Unit 2611

AD

MOHAMMED GHAYOUR
SUPERVISORY PATENT EXAMINER